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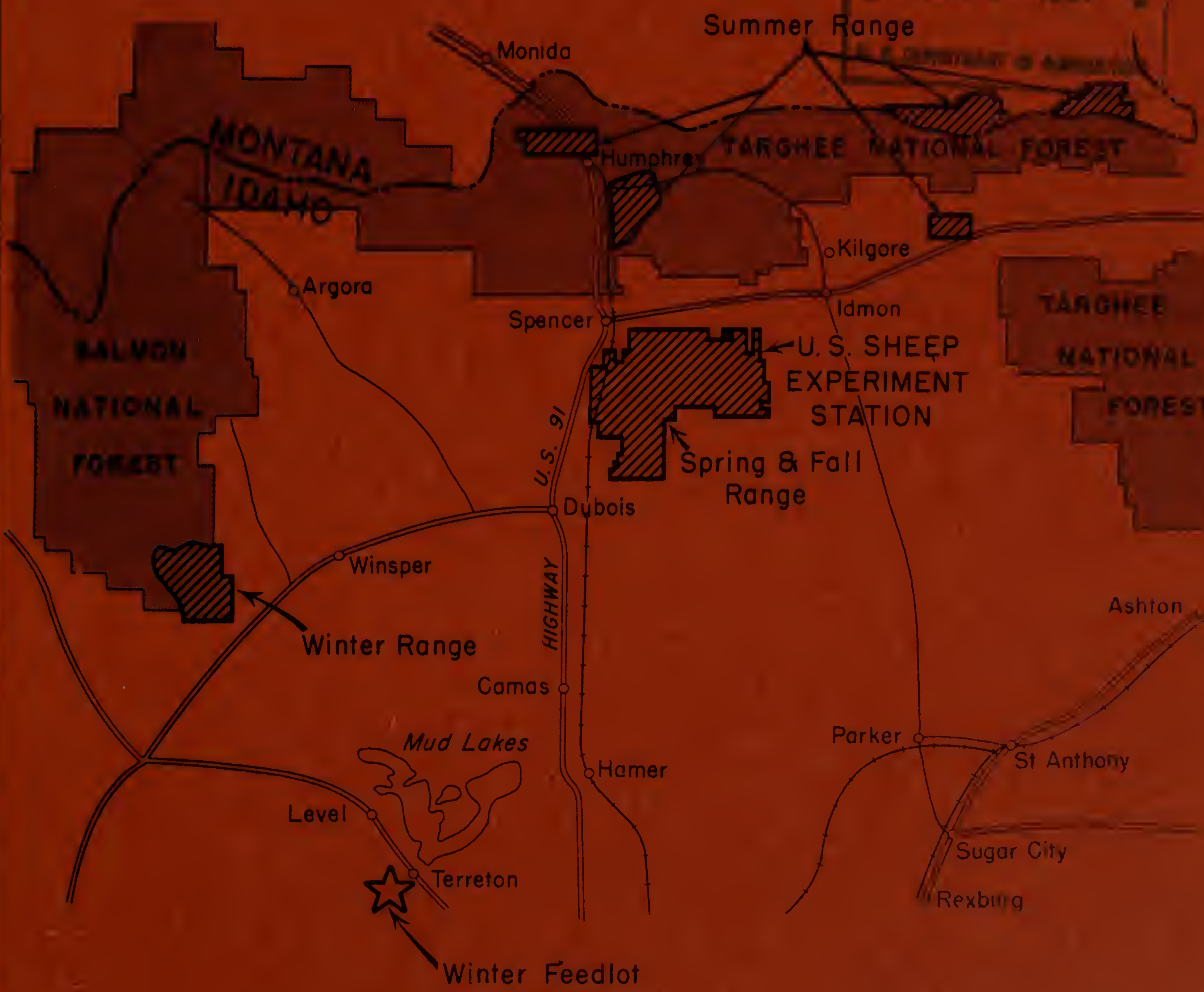
BUREAU OF ANIMAL INDUSTRY

THIRTEENTH ANNUAL REPORT OF THE
U.S. SHEEP EXPERIMENT STATION

DUBOIS, IDAHO
JUNE 30, 1950



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ANNUAL REPORT
U. S. Sheep Experiment Station
June 30, 1950

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ROSTER OF PERSONNEL

WESTERN SHEEP BREEDING LABORATORY AND U. S. SHEEP EXPERIMENT STATION
Dubois, Idaho
June 30, 1950

Name	Rating	Date Entered on Duty	General Duties
Nordby, Julius E.	Animal Husbandman	Mar. 1, 1938	Director
Terrill, Dr. Clair E.	Animal Husbandman	July 3, 1936	Genetics and Physiology
Stoehr, John A.	Animal Husbandman	Aug. 28, 1928	Operations
Kyle, Dr. Wendell H.	Animal Geneticist	July 7, 1949	Genetics and Statistics
Wilson, Lowell O.	Wool Technologist	July 1, 1943	Wool Technologist
Schaefer, Chester F.	Clerk	June 22, 1936	Chief Clerk
Dunn, Harry A.	Clerk	Aug. 22, 1949	Clerk
Hensley, Gladys L.	Clerk	Aug. 4, 1947	Clerk
Taylor, Jessie S.	Clerk	Aug. 25, 1947	Clerk
Twardak, Dorothy M.	Clerk	Sept. 7, 1948	Clerk
Jeffery, Lee C.	Foreman of Farm Laborers	June 7, 1924	General Maintenance, Pumps, Equipment
Rasmussen, Jr., Henry	Farm Laborer	July 1, 1926	Sub-Foreman
Anderson, Daniel	Farm Laborer	Aug. 4, 1947	Shepherd
Bybee, Bert L.	Farm Laborer	April 4, 1949	Farm Laborer
Gates, Kendrick J.	Farm Laborer	Nov. 29, 1948	Shepherd
Goldman, James R.	Farm Laborer	May 1, 1939	Shepherd
Hohman, Max E.	Farm Laborer	April 1, 1935	Shepherd
Howard John H.	Farm Laborer	Oct. 2, 1944	Camp Tender
Ingram, Parley F.	Farm Laborer	Apr. 20, 1947	Shepherd
Lake, Dee H.	Farm Laborer	May 1, 1950	Farm Laborer
Phillips, Walter H.	Farm Laborer	Mar. 16, 1935	Truck Driver
Powell, Fred A.	Farm Laborer	May 11, 1935	Teamster
Swink, Albert B.	Farm Laborer	May 31, 1946	Farm Laborer
Nantz, Mrs. Dorinda R.	Laborer	June 16, 1941	Janitress & Cook

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PUBLICATIONS

The following papers have been published or mimeographed by the U. S. Sheep Experiment Station since 1937. The complete list is included again this year for your convenience. Papers to which the Western Sheep Breeding Laboratory has contributed are starred. A number of contributions have been made to livestock journals and the general press that are not included in this series. They are for the most part adaptations of the regular series, prepared for the lay reader.

1. Measurement of Reproductive Capacity as an Aid in Selection of Rams of High Fertility (A preliminary report). C. E. Terrill, Proc. of the Amer. Soc. of An. Prod., 1937, pp. 311-316.

2. Artificial Insemination of Ewes. C. E. Terrill and E. M. Gildow, National Wool Grower, 27(12):35, Dec., 1937.

3. Another Experiment on Long Range Paternity in Sheep. C. E. Terrill and E. M. Gildow, Jour. of Heredity, 29(2):77-78, Feb., 1938.

4. Artificial Insemination of Ewes with Transported Semen. E. M. Gildow and C. E. Terrill, Jour. of Amer. Vet. Med. Assoc. N.S. 46(3):157-159, Sept., 1938.

*6. A Preliminary Study of the Relation Between Fleece Characteristics of Weanling and Yearling Range Sheep. W. V. Lambert, J. I. Hardy and R. G. Schott, Proc. of the Amer. Soc. of An. Prod., 1938, pp. 298-303.

*7. Reproduction in Range Sheep. C. E. Terrill and John A. Stoehr, Proc. of the Amer. Soc. of An. Prod., 1939, pp. 369-375.

*8. Selection of Range Rambouillet Ewes. C. E. Terrill, Proc. of The Amer. Soc. of An. Prod., 1939, pp. 333-340.

9. Comparison of the Accuracy of Two Methods of Estimating Fineness of Wool Fibers. Ralph W. Phillips, R. G. Schott, J. I. Hardy and H. W. Wolf, Jour. of Agr. Res. 60(5):343-350, Mar. 1, 1940.

10. A Summary of Three Year's Work in the Transportation of Ram Semen for Artificial Insemination. Ralph W. Phillips, R. G. Schott, E. M. Gildow and C. E. Terrill. Proceedings of the Second National Meeting of Veterinary Surgeons of Italy, 1940. pp. 231-237.

11. The Western Sheep Breeding Laboratory and U. S. Sheep Experiment Station. Julius E. Nordby, Extension Animal Husbandman, Sept., 1940.

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13. Some Factors Affecting the Progeny Testing of Rams. Ralph W. Phillips, R. G. Schott, W. V. Lambert and G. W. Brier, U.S.D.A. Cir. 580, 17 pp., Oct., 1940.

*14. The Application of a Rapid Comparator Method for Determining Fineness and Variability in Wool. Elroy M. Pohle, Proc. of the Amer. Soc. of An. Prod., 1940, pp. 161-168.

15. Comparison of Ram Semen Collection Obtained by Three Different Methods for Artificial Insemination. Clair E. Terrill. Proc. Amer. Soc. of An. Prod., 1940, pp. 201-207.

*16. Growth in Corriedale and Rambouillet Sheep under Range Conditions. Ralph W. Phillips, John A. Stoehr and G. W. Brier, Proc. of the Amer. Soc. of An. Prod., 1940 pp. 173-181.

*17. Sheep Improvement for Range Production. Julius E. Nordby, Idaho Forester 23, 1941, Forestry School, University of Idaho.

19. Columbia Sheep and Their Place in Range Sheep Production. Damon A. Spencer and John A. Stoehr, A.H.D. No. 42, Oct., 1941, 2 pp. (Processed).

20. Targhee Sheep and Their Place in Range Sheep Production. Damon A Spencer and John A. Stoehr, A.H.D. No. 43, Oct., 1941, 2 pp. (processed)

*22. Wool Yield Determination in which Small Samples are Compared with Whole Fleeces. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer, and Glenn W. Brier, A.H.D. No. 50, Jan., 1942, 6 pp. (Processed).

*23. Wool Yields in the Small Side-Sample as Related to Individual Whole-Fleece Yields in Four Breed-Groups of Sheep. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer and Glenn W. Brier, Jour. of An. Sci. 1(2):137-144, May 1942.

*24. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1(3):221-228, Aug., 1942.

*25. Relationship between Weanling and Yearling Fleece Characters in Range Sheep. Elroy M. Pohle, Jour. of An. Sci. 1(3):229-235, Aug., 1942.

*26. Staple Length in Relation to Wool Production. Elroy M. Pohle and Henry R. Keller, Jour. of An. Sci. 2(1):33-41, Feb., 1943.

*28. Staple Length and Its Influence on Shrinkage and Fleece Values. Elroy M. Pohle, and Henry R. Keller, National Wool Grower 33(6): 22-24, June, 1943.

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29. Stabilizing Wool and Body Type in White Faced Crossbred Sheep for Western Range Production. Julius E. Nordby, National Wool Grower 33(7):15-17, (8):16-18, July and August, 1943.

*34. Estimation of Clean-Fleece Weight from Grease-Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle, L. Otis Emik and Lanoy N. Hazel, Jour. of Agr. Res. 70(1):1-10, Jan. 1, 1945.

*35. Clean-Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(2):159-165, May, 1944.

*36. Shrinkage and Value by Grades for 1943 Range Wool. Elroy M. Pohle and Henry R. Keller. National Wool Grower 34(6):22-23, June, 1944. (Published in other Wool Growers Magazines).

37. Some Factors Affecting the Blood Phosphorus Level of Range Ewes. W. M. Beeson, Clair E. Terrill and D. W. Bolin, Jour. of An. Sci. 3(2):175-182, May, 1944.

38. The Accuracy of Measurements and Weights of Sheep. Ralph W. Phillips and John A. Stoehr, Jour. of An. Sci. 4(3):311-316, Aug., 1945.

*39. Monthly Changes in Fineness, Variability and Medullation in Hairy Lambs. Elroy M. Pohle, H. R. Keller and L. N. Hazel, Jour. of An. Sci. 4(1):37-46, Feb., 1945.

*41. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yields. E. M. Pohle, L. N. Hazel and H. R. Keller, Jour. of An. Sci. 4(2):104-112, May 1945.

*42. Wool Off-Sorts, Percentage, Shrink Value. Elroy M. Pohle and Henry R. Keller, Montana Wool Grower 18(6):7, June, 1944. (Published in Other Wool Growers Magazines.)

*44. Looking Forward, The Stabilizing Influence of Research in a Changing Sheep Production Economy. Julius E. Nordby, National Wool Grower 35(6):18-19, 35-36, June, 1945.

51. Effects of Some Environmental Factors on Weanling Traits of Range Columbia, Corriedale and Targhee Lambs. L. N. Hazel and Clair E. Terrill, Jour. an. Sci. 5(3):318-325, August, 1946.

52. Heritability of Weanling Traits in Range Columbia, Corriedale and Targhee Lambs. L. N. Hazel, and Clair E. Terrill. Jour. of An. Sci. 5(4):371-377, November, 1946.

*54. Length of Gestation in Range Sheep. Clair E. Terrill and L. N. Hazel, Amer. Jour. Vet. Res. 8(26):66-72, January, 1947.

56. Breed Crosses Used in the Development of Targhee Sheep. Clair E. Terrill. Jour. of An. Sci. 6(1):83-92, February, 1947.

*57. Range Sheep Improvement Through Selection. Clair E. Terrill. National Wool Grower 36(12):17-19, December, 1946.

58. Color on the Legs of Sheep. Its Inheritance in the Columbia and Targhee Breeds. Clair E. Terrill. Jour. Hered. 38(3):89-92, March, 1947.

59. Effects of Some Environmental Factors on Yearling Traits of Columbia and Targhee Ewes. Clair E. Terrill, G. M. Sidwell and and L. N. Hazel. Jour. An. Sci. 6(2):115-122, May, 1947.

*60. It's the Clean Wool in the Fleece that Pays Off. Elroy M. Pohle. National Wool Grower 37(5):19-20, May, 1947.

*61. Statistical Treatment of Trichostrongylid Eggs. L. Otis Emik. Biometrics 3(2):89-93, June, 1947.

*62. Factors Affecting the Estimation of Concentration of Ram's Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Journal of Animal Science 6(4):467-475, Nov., 1947.

63. Development of Targhee Sheep. Clair E. Terrill and John A. Stoehr. National Wool Grower, 37(11):13-14, Nov., 1947.

*65. Gestation Period in Sheep. Clair E. Terrill and John A. Stoehr. Sheep and Goat Raiser 28(6):23, March, 1948. (Published in other Wool Growers Magazines.)

66. Effects of Some Environmental Factors on Yearling Traits of Columbia and Targhee Rams. Journal of Animal Science 7(2):181-190, May, 1948.

*69. Effect of Feed and Sickness on Wool Growth. Elroy M. Pohle. National Woolgrower 37(6), June, 1947.

*70. High Producing Rams Important. Elroy M. Pohle. National Wool-Grower 38(1):21-22, January, 1948.

*71. Fleece Vlaue Increases with Staple Length. Thos. D. Watkins, Jr. National Wool Grower 38(10):17-18, October, 1948. (Published in other Wool Growers Magazines.)

*72. Systematic Procedures for Calculating Inbreeding Coefficients. L. Otis Emik and Clair E. Terrill. Journal of Heredity 40(2): 51-55, Feb., 1949.

*73. Increasing Accuracy of Selecting Rams. To be processed by A. H. Div., Bur. of An. Ind., U.S.D.A.

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*75. Activating Genetic Concept into Range Sheep Improvement. Julius E. Nordby. Northwest Science, 22(2):60-68, May, 1948.

*77. Science as a means of Sheep Improvement. Julius E. Nordby. Montana Wool Grower 23(1):17, 64, January, 1949.

*78. Dangers and Benefits of Inbreeding. Julius E. Nordby, National Wool Grower 39(1):12-13, 40,42, January, 1949.

*81. Wintering Ewe Lambs. John A. Stoehr and Clair E. Terrill. National Wool Grower 40(2):14-15, February, 1950.

*82. Comparison of Rubber Rings with Cutting for Docking and Castrating. Clair E. Terrill and John A. Stoehr. National Wool Grower 40(3): 23, March, 1950.

84. Stocking Northern Great Plains Sheep Range for Sustained High Production. E. J. Woolfolk. U.S.D.A. Cir. 804, 39 pp., April,1949. (Sheep from the U. S. Sheep Experiment Station were used in this study).

85. Grazing Spring-Fall Sheep Ranges of Southern Idaho. J. F. Pechanec and George Stewart. U.S.D.A. Cir. 808, 34 pp., May, 1949.

*86. The Semen Production of Rams Under Range Conditions. L. Otis Emik and Clair E. Terrill. For Journal of Animal Science.

*87. The Effect of Successful Embryo Transplantations on the Progress Expected from Selection. W. H. Kyle. For Journal of Animal Science.

*89. The Influence of Research upon Sheep Production Economy. Julius E. Nordby. San Angelo Standard-Times, April 20, 1950.

*90. Keep Range Livestock on Job Building Soil. A Condensation of Talk given at the Annual Meeting of the Idaho Soil Conservation District Supervisors at Lewiston, November 7, 1949. Julius E. Nordby. Idaho Farmer, January 5, 1950.

ABSTRACTS

The following abstracts have been published by the U. S. Sheep Experiment Station since 1937. Abstracts to which the Western Sheep Breeding Laboratory has also contributed are starred. In general these are abstracts of work that has been or will be published and listed in the regular series of publications.

*1. Relationship Between Weanling and Yearling Fleece Characters in Range Sheep. Elroy M. Pohle, Jour. of An. Sci. 1(1):60,Feb., 1942.

* 2. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1(1):60-61, Feb., 1942.

* 5. Estimation of Clean Fleece Weight from Unscoured Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle and L. Otis Emik, Jour. of An. Sci. 1(4):357, Nov., 1942.

8. The Effect of Some Factors on the Blood Phosphorus Level of Range Ewes. W. M. Beeson, Clair E. Terrill and D. W. Bolin, Jour. of An. Sci. 2(4):369, Nov., 1943.

* 9. Clean Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 2(4):370, Nov., 1943.

*12. The Gestation Period of Range Sheep. Clair E. Terrill. Jour. of An. Sci. 3(4):434-435, Nov., 1944.

*13. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yield. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(4):452, Nov., 1944.

*16. Factors Affecting the Estimation of Concentration of Sperm in Rams' Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Anat. Rec. 97(3):69-70, March, 1947.

17. The Nature of Genetic Resistance of Sheep to Trichostrongylid Worms. L. Otis Emik. Jour. An. Sci. 5(4):415-414, Nov., 1946.

18. Inheritance of Color on the Legs in Columbia and Targhee Sheep. Clair E. Terrill, Jour. An. Sci. 5(4):414, November, 1946.

*19. The Effects of Environmental and Hereditary Factors on Trichostrongylid Worm Infestation on Sheep. L. Otis Emik and Paul W. Gregory. Jour. An. Sci. 6(4):477-478, Nov., 1947.

*21. Predicting Live Normal Sperm in Rams from Motility Scores. L. Otis Emik, Clair E. Terrill and Geo. M. Sidwell. Jour. An. Sci. 7(4):511, November 1948.

*22. The Semen Production of Rams Under Range Conditions. L. Otis Emik and Clair E. Terrill. Jour. of An. Sci. 8(4):605, Nov.,1949.

*23. The Effect of Successful Embryo Transplantations on the Progress Expected from Selection. W. H. Kyle. Jour. of An. Sci. 8(4): 607, November, 1949.

PROGRESS IN DEVELOPING LINES OF COLUMBIA AND TARGHEE SHEEP

Matings of Columbias were continued in 10 lines and 2 test pens in the fall of 1949. The number of ewes bred in lines decreased from 381 in 1948 to 343 in 1949. 152 ewes were used in cross-line matings as compared to 163 in 1948. Two ram lambs were each progeny tested on 19 or 20 first cross Columbia ewes. Inbreeding coefficients are not yet available for Columbias. It is hoped that these can be brought up to date within the next year.

The 8 Targhee lines which were established in 1940 were continued by using one ram in each line except for the largest line (4T) where 2 rams were used. The progress in inbreeding in these lines is shown in the following table:

Year Lambed	No. of Lines	No. of ewes bred	Average inbreeding coefficients in percent: Sires	Dams	Progeny	Increase of progeny over dams	Highest for progeny of any pen	Highest for any individual offspring
1941	8	192	8.2	3.5	9.6	6.1	16.4	30.9
1942	8	183	8.5	3.5	10.6	7.1	17.4	34.9
1943	8	202	7.2	3.5	10.6	7.1	22.5	34.9
1944	8	223	8.7	4.6	11.2	6.6	16.0	31.0
1945	8	257	5.0	7.5	13.1	5.6	20.8	35.9
1946	8	245	3.4	7.2	11.5	4.3	18.9	36.2
1947	8	267	5.5	8.0	13.5	5.5	21.9	41.4
1948	7	226	11.4	8.4	16.3	7.9	19.8	44.7
1949	8	255	14.2	9.4	16.9	7.5	23.4	35.2

Since 1948 the inbreeding of sires used has been higher than that of ewes. The inbreeding of offspring has increased a little less than 1 percent per year. The increase in inbreeding of progeny over dams has been greater in the last 2 years.

An additional 6 lines which have been started in recent years are not included in the table because inbreeding coefficients have not yet been calculated for all of these lines and because first crosses are still being made for some of these 6 lines. Ten Targhee rams were used in progeny test matings involving 17 to 20 ewes each in 1949. In addition, 13 first and second cross ewes having Border Leicester blood were mated to polled Rambouillet rams. The offspring from these matings, if suitable may be used later in Targhee breeding.

SELECTION PRACTICED ON COLUMBIA AND TARGHEE WEANLING LAMBS

Weanling selection differentials demonstrate the amount of selection actually practiced on each crop of lambs. Considerable later selection is practiced on rams but most of the effective selection of ewes is made at weaning age.

The selection differentials, shown in the table for lambs selected in 1949, represent the average differences between selected lambs and all lambs weaned, after corrections for environmental influences have been made. Many of the selection differentials were higher in 1949 than in 1948, probably because lower proportions of lambs were selected in 1949. Selection differentials were greater for Targhees than for Columbias in every case. The differences were greatest for staple length and face covering. The greater intensity of selection in Targhees and the use of a selection index in Targhees probably account for these differences.

Weanling lambs selected from Columbias and Targhees, respectively, represented 50 and 37 percent of the ram lambs and 69 and 59 percent of the ewe lambs. The proportions selected were considerably lower than those in other recent years. It is likely that the percentage of ewe lambs selected in 1949 is too low to permit any culling on yearling fleece records without a reduction in flock size.

The heritability estimates in the accompanying table were reported by Hazel and Terrill in 1946 and are based on records of Columbia, Targhee and Corriedale lambs. Separate and reliable heritability estimates are needed for Columbias and Targhees in order to set up a Columbia weanling index and to increase the accuracy of the Targhee weanling index. The weanling index now being used in Targhees was developed for Rambouillet lambs in which heritabilities and relationships between traits may differ from those in Targhees.

The expected genetic gain per generation for each sex is the selection differential times one-half of the heritability. The sum of the products for both sexes gives the expected genetic gain per generation from the selection practiced on both sexes.

The relative emphasis on each trait was calculated by dividing the selection differential by the standard deviation. Emphasis was greatest on type score in all groups except Targhee ewes in which weaning weight received the greatest relative emphasis. The low heritability of type score would seem to indicate that at least part of the selection pressure exerted on type could profitably be shifted to other more highly heritable traits. The emphasis on neck folds in Targhees may also be too great for the same reason. Staple length probably deserves greater emphasis in Columbias if this can be accomplished without increasing fiber diameter. If length is increased density should likewise be increased to maintain tightness in the fleece.

SELECTION STATISTICS FOR COLUMBIA AND TARGHEE WEANLING LAMBS IN 1949

	Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
Heritability	46%	43%	17%	7%	21%	8%
COLUMBIA						
Rams						
Selection differential	.05	-.06	3.87	.17	.16	.03
Expected genetic gain per generation	.012	-.013	.329	.006	.017	.001
Ewes						
Selection differential	.02	.04	2.43	.13	.13	.01
Expected genetic gain per generation	.005	.009	.207	.005	.014	.000
Rams and Ewes						
Expected genetic gain per generation	.017	-.004	.536	.011	.031	.001
TARGHEE						
Rams						
Selection differential	.32	.20	5.01	.28	.23	.10
Expected genetic gain per generation	.074	.043	.426	.010	.024	.004
Ewes						
Selection differential	.09	.07	3.45	.14	.17	.05
Expected genetic gain per generation	.021	.015	.293	.005	.018	.002
Rams and Ewes						
Expected genetic gain per generation	.095	.058	.719	.015	.042	.006

Selection differentials expressed as fractions of a standard deviation.

Columbia Rams	.12	-.08	.33	.39	.31	.10
Columbia Ewes	.05	.05	.21	.30	.25	.03
Targhee Rams	.54	.44	.50	.61	.45	.22
Targhee Ewes	.15	.16	.35	.30	.33	.11

Annual genetic improvement depends partly on the length of the generation interval, which is the average age of the parents when their offspring are born. The following table presents the average ages of dams, sires and both parents for lambs born from 1944 through 1949.

Year lambs were born	COLUMBIA Average age of: Dams (years)	Sires (years)	Dams & Sires (years)	TARGHEE Average age of: Dams (years)	Sires (years	Dams & Sires (years)
1944	3.98	2.55	3.265	4.27	2.90	3.588
1945	4.12	2.87	3.495	4.52	2.15	3.334
1946	4.26	2.83	3.544	4.52	3.32	3.916
1947	4.36	2.62	3.490	4.32	2.39	3.355
1948	4.30	2.30	3.296	3.97	2.02	2.992
1949	4.41	2.38	3.396	3.75	2.36	3.059

The average age of parents was highest in 1946 for both Columbias and Targhees and lowest in 1944 for Columbias and in 1948 for Targhees. The average ages of Columbia sires and dams increased slightly over 1948. In Targhees, the average age of dams was lower in 1949 than in any other year but the average age of sires increased slightly over 1948. Thus, in 1949 the generation interval was slightly longer for both Columbias and Targhees than in 1948.

The estimated annual genetic improvement resulting from weanling selections is the expected genetic gain per generation from selection of both sexes divided by the generation interval. These rates for each weanling trait in Targhees and Columbias for lambs born from 1944 through 1949 are shown in the following table:

Year	Face covering score	Staple length (cms.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
			COLUMBIA			
1944	.007	.005	.076	.002	.004	.001
1945	.018	.013	.171	.004	.011	.001
1946	.014	-.001	.087	.002	.006	.000
1947	.010	.003	.121	.001	.006	.000
1948	.009	.001	.074	.002	.006	.000
1949	.005	-.001	.158	.003	.009	.000
			TARGHEE			
1944	.009	.009	.085	.003	.006	.002
1945	.021	-.001	.095	.004	.010	.002
1946	.008	.013	.115	.003	.006	.001
1947	.026	.017	.156	.002	.010	.001
1948	.027	.007	.127	.002	.003	.001
1949	.031	.019	.235	.005	.014	.002

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These rates increased in 1949 for every trait in Targhees and for weaning weight, type and condition in Columbias. Estimated annual genetic improvement decreased for face covering and became negative for staple length. If the heritability estimates used are reasonably accurate, little improvement can be expected in neck folds and only slow improvement in type, despite intense selection for the latter. The increase in expected genetic gains for Targhee face covering and weaning weight since 1946 may be due to the use of a selection index beginning in 1947.

BREED CROSSES

Various breed crosses were continued from 1947 through 1949 to explore the possibilities of improving Targhees by breeding from the New Zealand Merino or the Border Leicester. In addition, Columbia-Targhee and Corriedale-Rambouillet crosses were made to broaden the base of the Columbia and Targhee breeds, respectively. Weanling averages are presented in the accompanying tables for each trait for each of the crosses involved and for straight Targhees.

Merino-Targhee crossbred lambs had shorter staple, lighter body weights, poorer type scores, more open faces, and more neck folds than straight Targhees. Both Columbia-Targhee crosses and both crosses having Border Leicester breeding excelled straight Targhees in length of staple, weaning weight, type, condition and face covering in 1948. Crossbreds containing Leicester breeding in 1949 were slightly poorer in weaning weight and condition scores than in 1948. Crossbreds with Leicester breeding are now being mated to polled Rambouillets because their fleeces are much coarser than Targhee fleeces. Rambouillet-Corriedale crossbred lambs had more covered faces, lighter weaning weights and poorer type and condition scores than straight Targhees.

BREED CROSSES BORN IN 1948

Breed of sire	Breed of dam	No. of lambs	Staple length	Weaning weight	Type	Condition	Face cov.	Neck folds	Index
			cms.	lbs.	score	score	score	score	
Targhee	Targhee	251	3.74	78.0	1.79	2.09	3.79	1.09	131
Merino (3A45)	Targhee	49	3.73	68.5	1.86	2.05	3.43	1.51	126
Columbia	Targhee	87	4.22	83.1	1.70	1.97	3.13	1.03	
Targhee	Columbia	34	4.02	81.4	1.68	1.94	3.08	1.16	
Rambouillet	Corriedale	78	3.65	70.1	1.86	2.14	3.82	1.10	126
Lst. x Ramb.	Targhee	15	3.96	84.8	1.61	1.84	3.22	1.02	145
Breed crosses born in 1949									
Targhee	Targhee	337	3.84	81.1	1.72	2.52	3.55	1.12	142
Merino (80W)	Targhee	43	3.60	76.4	2.02	2.68	3.41	1.32	138
Rambouillet	Corriedale	44	4.16	73.2	1.89	2.41	3.73	1.14	134
Lst. x Targhee	Targhee	18	4.27	79.0	1.60	2.66	2.93	1.00	157

LINE CROSSES IN COLUMBIAS

Studies of the advantages of lambs from crosses of inbred lines of Columbias were continued on the lamb crop of 1949. Inbred lambs from lines used in crossing were inferior to inbred lambs from all Columbia lines for each trait except body type score which was equal to that for all lines. Inbred ewes and ewes obtained from 2- and 3-line crosses were mated to inbred rams from different lines to produce cross-line offspring. Cross-line lambs were superior to inbred (straight-line) lambs in every trait except face covering and here the difference was slight. The advantages were 2 percent for staple length, 4 percent for weaning weight, 7 percent for condition score, and 8 percent for body type score. It should be pointed out that these weanling data have not been corrected for inbreeding because the Columbia inbreeding coefficients are not yet available. However, the difference in inbreeding between cross-line and straight-line lambs may not be large because of the high relationship among Columbia lines. Under these conditions great superiority of the cross-line lambs could not be expected.

Ewes producing cross-line offspring excelled those producing inbred offspring in lamb production. Inbred ewes mated to rams from other lines excelled inbred ewes mated to rams from their own lines by 12.2 percent of lambs weaned, by 1.3 pounds of average weaning weight and by 11.2 pounds of lamb weaned per ewe bred. Crosses involving 3 or more lines excelled all inbred lines by 4.1 percent of lambs weaned, by 2.5 pounds of average weaning weight and by 5.2 pounds of lamb weaned per ewe bred in spite the younger age of the cross-line ewes. These data have not been corrected for inbreeding.

Crossline matings will be continued in 1950 by mating rams from lines 2, 4, 8, 9 and 10 to cross-line ewes to obtain information on the general crossing ability of these lines. In each case rams from one line will be mated to ewes of that line and to ewes resulting from crosses of 2 or more other lines.

PROPOSED PLAN TO SELECT FOR COMBINING ABILITY IN THE DEVELOPMENT OF THREE TARGHEE INBRED LINES

Recent work with plants and other species of animals indicates that the combining ability of an inbred line can be detected early in its development and can be improved by selection. Selection within a line for combining ability with another line or a tester group is difficult with sheep because of the low reproductive rate. Preliminary attempts at recurrent selection are needed with sheep in order to work out effective ways of carrying on such selection and to point the way for possibily more extensive work later.

Three Targhee lines (4T, 9T and 5-) of diverse genetic origin will be used in a system of recurrent selection beginning in the breeding season of 1950. Each line will be divided at random into 2 groups. Half of each line (about 30 ewes) will be continued as an inbred line (lines 4T, 9T and 5-) as in the past by selecting sires

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from within the line without progeny testing. The other hald of each line (lines 10T, 11T and 12T, respectively) will be used in a system of recurrent selection using test ewes from outside the lines (6 to 10 groups of 5 to 10 ewes for each line each year) to test 6 to 10 yearling rams from each line each year. The test ewes will be maintained as a continuous group by mating test offspring of line A to rams of line B, test offspring of line B to line C, and test offspring of line C to line A. Excess ewes in the recurrent selection lines above 30 could also be used in testing rams. The best ram on the basis of his test offspring will be used in the line the next year and a new sire for each of the 3 lines (10T, 11T and 12T) would be selected in this manner each successive year. Male crossline or test offspring would be sold. In the first generation, sires will be selected for general combining ability but in the second generation, sires will be selected in part for specific combining ability since the test ewes will carry half of the genes of another line. In the 3rd and later generations, combining ability with a second line will also be partially tested. Ewe offspring in the recurrent selection lines (10T,11T and 12T) will be selected on the basis of their individual merit for replacements in their respective lines.

RELATION OF FLEECE GRADE TO LAMB PRODUCTION OF COLUMBIA EWES

Preliminary results are available on the relation of fleece grade to lamb production of 681 Columbia ewes born during the years from 1941 through 1945. Five years' lamb production was used for ewes born from 1941 through 1943, and 4 and 3 years production was used for those born in 1944 and 1945, respectively, making a total of 2210 lambing years. All fleeces were graded each year at shearing time.

Five classes of ewes were studied: those grading 3/8 Blood or finer each year, those grading 3/8 Blood a majority of the years, those grading 3/8 Blood half of the years and 1/4 Blood half of the years, those grading 1/4 Blood a majority of the years, and those grading 1/4 Blood or coarser all of the years. Ewes in the intermediate class excelled in lamb production, producing 1.7 and 2.9 pounds more lamb per year for Columbia and second-cross Columbia ewes, respectively, than ewes having a majority of 3/8 Blood fleeces. The latter produced 4.9 and 8.7 pounds more lamb per year for the respective groups than ewes having a majority of 1/4 Blood fleeces. The latter group was only slightly superior in lamb production to the two remaining groups.

It appears that Columbia ewes having fleeces of intermediate fineness for the breed were the best lamb producers during these years.

SEMEN PRODUCTION OF RANGE RAMS

Preliminary studies were made on semen samples from 301 Columbia, 200 Targhee, 385 registered and 439 unregistered Rambouillet rams over the 10 year period from 1937 through 1946. These semen samples were collected each fall before breeding to detect rams of low fertility and to avoid their use in breeding. Up to 7 ejaculates were produced

by one ram in a 30 minute trial period but the average was 2.6 ejaculates. Semen produced per trial averaged 2.07 ml. or 0.79 ml. ejaculate. The largest ejaculate produced was about 3 ml. Concentration of spermatozoa per ml. varied from zero to 7 billion with an average of 2.63 billion per ml. and an average total number of 5.77 billion per trial. The average percentage of motile spermatozoa was 81.5 There was an average production of 5.23 billion live normal sperm per trial.

Semen production was poorest in 1941 and best from 1944 to 1947. Changes in feeding and management of the rams and an increase in the proportion of younger rams in the later years were believed to be responsible for the improvements. Definite breed differences in semen production were not apparent. In general, semen production improved up to 2 years of age and declined thereafter.

USE OF CORE BORE TEST TO DETERMINE CLEAN YIELD OF INDIVIDUAL FLEECES

Preliminary work, in cooperation with the Denver Wool Laboratory, was completed on the use of the core-bore test to determine the clean yield of individual fleeces. Clean yields of 84 yearling ewe fleeces were obtained from core-bore samples and from the whole fleeces. The core-bore clean yields gave accurate estimates of whole-fleece clean yields as shown by the highly significant correlation coefficient of 0.94 between the clean fleece weight from the core-bore test and the whole-fleece clean weight.

COMMERCIAL GRADES OF COLUMBIA FLEECES

		Yearling				Mature			
Sex	Year	1/2 Blood	3/8 Blood	1/4 Blood	L 1/4 Blood	1/2 Blood	3/8 Blood	1/4 Blood	L 1/4 Blood
		%	%	%	%	%	%	%	%
Rams	1942-45	6	60	34		2	58	40	
	1946	5	57	38			26	74	
	1947	3	56	41		2	40	58	
	1948	6	71	23			50	46	4
	1949	11	77	11	1		61	39	
Ewes	1942-45	5	66	29		6	53	41	
	1946	4	42	53		3	47	50	
	1947	6	63	31		3	47	50	
	1948	6	69	24	1	2	47	45	6
	1949	9	70	19	2	4	42	50	4

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

All groups of Columbias except mature ewes showed an increase in the proportion of fleeces grading 3/8 Blood in 1949 over 1948. In addition each group showed an increase in the proportion grading 1/2 Blood except mature rams which produced no 1/2 Blood fleeces in 1949. In all groups except mature ewes the proportion of fleeces grading 1/2 Blood and 3/8 Blood in 1949 was highest for any year since the grading of fleeces was initiated in 1942. These changes toward finer fleeces, although slight, may indicate that progress is being made toward eliminating the coarser grades of wool from Columbias. However, changes in grading standards from year to year may partially account for the changes observed.

COMMERCIAL GRADES OF TARGHEE FLEECES

		Yearling				Mature				
Sex	Year	Fine Staple	1/2 Blood	3/8 Blood	1/4 Blood	Fine French	Fine Staple	1/2 Blood	3/8 Blood	1/4 Blood
		%	%	%	%	%	%	%	%	%
Rams	1942-45	8	78	14			2	88	8	2
	1946	8	81	11		3	6	71	20	
	1947	13	63	22	2		7	78	11	4
	1948	30	60	10			8	77	15	
	1949	13	75	11	1			43	57	
Ewes	1942-45	7	79	14		2	11	79	7	1
	1946	8	76	16		5	13	70	10	2
	1947	23	62	14	1	4	12	68	15	1
	1948	16	73	9	2	5	21	62	11	1
	1949	12	46	40	2	1	6	54	38	1

There appeared to be a shift toward coarser fleeces in all 4 groups of Targhees in 1949. This was least evident in Targhee yearling rams where 75 percent of the fleeces were graded 1/2 Blood and 13 percent were graded Fine Staple. Changes in grading standards from year to year may partially account for the changes observed.

SORTING OF INDIVIDUAL FLEECES IN 1949

All fleeces were sorted individually in 1949 by one Bureau employee and three commercial wool sorters from the Wool Division with varying degrees of experience. Fleeces of mature ewes and rams represent one year's growth. Fleeces of yearling ewes and rams had an average growth period of 395 days. All ewes were crutched in early spring. The following tables present the summaries of wool sorting data from 1949 Columbia and Targhee fleeces:

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1949 COLUMBIA WOOL SORTING SUMMARY

Description	Yearling ewes: Average weight per fl. (lbs.)	Yearling ewes: % of total weight sorted	Mature ewes: Average weight per fl. (lbs.)	Mature ewes: % of total weight sorted	Yearling rams: Average weight per fl. (lbs.)	Yearling rams: % of total weight sorted	Mature rams: Average weight per fl. (lbs.)	Mature rams: % of total weight sorted
Main sorts and other matchings								
64s and finer								
Fine Staple	--	--	--	--	.06	.54	--	--
Fine French	--	--	--	--	--	.04	--	--
60s and 62s								
1/2 Staple	.02	.30	.01	.08	.22	2.09	--	--
1/2 French	.15	1.81	.09	.84	.27	2.59	--	--
56s and 58s								
3/8 Staple	2.88	35.88	2.43	21.66	.83	7.93	1.15	7.91
3/8 French	.09	1.14	.19	1.72	1.31	12.62	.11	.78
3/8 Clothing	.01	.09	--	.01	.07	.65	--	--
50s								
1/4 Staple	2.61	32.47	3.93	35.07	4.33	41.57	7.03	48.18
1/4 Clothing	.09	1.14	--	--	.08	.74	--	--
46s and 48s								
Low 1/4	.84	10.46	2.96	26.38	.97	9.34	3.41	23.37
44s								
Common	.12	1.50	.23	2.03	.01	.09	.01	.08
TOTAL MATCHINGS	6.81	84.79	9.84	87.79	8.15	78.20	11.71	80.32
Main sorts	5.23	65.14	7.76	69.23	6.83	65.53	9.99	68.49
Other matchings	1.58	19.65	2.08	18.56	1.32	12.67	1.72	11.83
Offsorts								
Burry	.99	12.35	.65	5.84	1.12	10.74	2.03	13.92
Stained & tags	.18	2.18	.34	3.07	.94	9.04	.74	5.06
Paint	.05	.68	.37	3.30	.21	2.02	.10	.70
Total Offsorts	1.22	15.21	1.36	12.21	2.27	21.80	2.87	19.68
TOTAL SORTED	8.03	100.00	11.20	100.00	10.42	100.00	14.58	100.00
TOTAL SHORN	8.49	105.73	11.59	103.50	11.12	106.74	15.29	104.86
Difference	-.46	-5.73	-.39	-3.50	-.70	-6.74	-.71	-4.86
Number of fleeces	170		537		115		41	

1949 TARGHEE WOOL SORTING SUMMARY

Description	Yearling ewes		Mature ewes		Yearling rams		Mature rams	
	Average weight per fl. (lbs.)	% of total weight sorted	Average weight per fl. (lbs.)	% of total weight sorted	Average weight per fl. (lbs.)	% of total weight sorted	Average weight per fl. (lbs.)	% of total weight sorted
Main sorts and other matchings								
64s and finer								
Fine Staple	.37	4.61	.12	1.10	.66	6.40	--	--
Fine French	.36	4.46	.24	2.24	.59	5.73	--	--
Ave. French	.01	.08	--	.01	.01	.07	--	--
Fine Clothing	--	.04	--	--	--	--	--	--
60s and 62s								
1/2 Staple	.94	11.54	3.74	34.32	.63	6.07	.92	6.15
1/2 French	1.80	22.23	.35	3.18	3.75	36.25	2.69	18.04
1/2 Clothing	.04	.49	.01	.13	.08	.82	--	--
56s and 58s								
3/8 Staple	1.06	13.12	3.51	32.18	.56	5.41	.95	6.34
3/8 French	1.99	24.51	.68	6.21	1.06	10.21	2.47	16.52
3/8 Clothing	.07	.85	.01	.10	.06	.60	.01	.09
50s								
1/4 Staple	.02	.29	.59	5.38	.61	5.88	4.06	27.20
1/4 Clothing	.17	2.06	--	.01	.01	.11	.65	4.33
46s and 48s								
Low 1/4	.02	.24	.09	.81	.12	1.18	.41	2.78
TOTAL MATCHINGS	6.85	84.52	9.34	85.67	8.14	78.73	12.16	81.45
Main sorts	5.51	67.92	8.04	73.74	6.84	66.20	10.21	68.42
Other matchings	1.34	16.60	1.30	11.93	1.30	12.53	1.95	13.03
Offsorts								
Burry	1.02	12.61	.73	6.66	.84	8.07	1.62	10.84
Stained & tags	.21	2.52	.24	2.18	1.12	10.87	.96	6.41
Paint	.03	.35	.60	5.49	.24	2.33	.19	1.30
TOTAL OFFSORTS	1.26	15.48	1.57	14.33	2.20	21.27	2.77	18.55
TOTAL SORTED	8.11	100.00	10.91	100.00	10.34	100.00	14.93	100.00
TOTAL SHORN	8.53	105.12	11.20	102.69	11.06	107.02	15.60	104.49
Difference	-.42	-5.12	-.29	-2.69	-.73	-7.02	-.67	-4.49
Number of fleeces	185		627		106		43	

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The weights and percentages opposite "Difference" at the bottom of the tables, indicate differences between sorting and shearing weights and may be accounted for by sweepings, moisture changes, etc. "Main sort" is an arbitrary classification of the largest matching when it weighs at least 25% more than the next largest matching.

The average unadjusted differences in shorn fleece weights between mature and yearling ewes were 3.10 lbs. and 2.67 lbs., respectively, for Columbias and Targhees, and the differences between mature and yearling rams were 4.17 lbs. and 4.54 lbs., respectively. The average differences in shorn fleece weights between yearling rams and ewes were 2.63 lbs. and 2.53 lbs., respectively, for Columbias and Targhees, and the differences between mature rams and ewes were 3.70 lbs. and 4.40 lbs., respectively. These figures are only rough approximations of the real age and sex differences because they are uncorrected for various environmental effects, previous selections and other genetic changes.

The percentage of wool placed in offsorts is a partial reflection of the environmental conditions to which the sheep were subjected. In both Columbias and Targhees, yearling rams had the greatest percentage of offsort wool followed by mature rams, yearling ewes and mature ewes.

The use of scourable branding fluid now makes it possible to include the paint wool in matchings and to eliminate the paint sort. Excluding the paint sort, offsorts range from about 9% in mature ewes to about 20% in yearling rams. Since the burry sort contained mostly hay chaff, seeds and very few burs, changes in the method of feeding hay would probably be necessary to greatly reduce the offsort percentages.

1949 COLUMBIA WOOL STATISTICS

	Yearling ewes	Mature ewes	Yearling rams	Mature rams
	Percent of total matchings sorted			
Fineness grade (all lengths)				
Fine (64s and finer)	--	--	.74	--
1/2 Blood (60s & 62s)	2.49	1.05	5.99	--
3/8 Blood (56s & 58s)	43.77	26.64	27.11	10.82
1/4 Blood (50s)	39.64	39.95	54.10	59.98
Low 1/4 Blood (46s & 48s)	12.33	30.05	11.94	29.10
Common (44s)	1.77	2.31	.12	.10
	Mean fiber diameter in microns (from cross-sections)			
	25.67	--	25.81	28.92
	Spinning count (A.S.T.M. standards for wool tops)			
	58s	--	58s	56s
	Percent of total matchings sorted			
Length (all grades)				
Staple	95.07	97.07	78.72	99.03
French and Clothing	4.93	2.93	21.28	.97
	Average staple length in inches			
	3.99	--	4.14	4.52

Two main factors, apparent fiber diameter and staple length, largely determine the classification of matchings. The preceding table gives the percentage distributions of Columbia matchings based on grade and length classes separately along with information from cross-sections and staple length measurements. Mean fiber diameter was determined from shoulder, back and hip samples taken from each sheep except mature ewes, just before shearing. These cross-sections show that yearling ram fleeces were slightly coarser than yearling ewe fleeces although both would qualify as 58s. In sorting, approximately 46% of yearling ewe matchings were classed as 3/8 Blood or finer, while only 34% of yearling ram matchings were placed in this class. The difference is larger than would be expected on the basis of the small difference in average fiber diameter and may be partially due to greater staple length and boldness of crimp in yearling ram fleeces. Mature ram fleeces were coarser, by cross-section, than yearling fleeces and it appears that a larger proportion of matchings from mature ram fleeces would have been sorted into 3/8 Blood on basis of cross-section diameter.

Staple length was measured near the middle of the side on all sheep, except mature ewes, just before shearing. Of course the shorn wool would be slightly shorter than the wool measured on the sheep. Also there would be some variation in staple length over the fleece. The length requirements for Staple wool used in sorting were 2 1/2 inches for Fine, 3 inches for 1/2 and 3/8 Blood, 3 1/4 inches for 1/4 Blood, 4 inches for Low 1/4 and 5 inches for common.

Sorting results with respect to staple length are not consistent with actual measurements. Yearling Columbia ram fleeces were sorted as having shorter staple than measurement data indicate. Staple length of mature Columbia ram fleeces was greater than that of yearling fleeces as indicated by both sorting results and actual measurements. Staple length of mature Columbia ewe fleeces appeared to be slightly longer than yearling fleeces on the basis of sorting results but data from previous years indicate that mature ewes have shorter staple than yearling ewes.

The following table presents the sorting results and data from cross-sections and measurements of 1949 Targhee fleeces:

1949 TARGHEE WOOL STATISTICS

	Yearling ewes	Mature ewes	Yearling rams	Mature rams
	Percent of total matchings sorted			
Fineness grade (all lengths)				
Fine (64s and finer)	10.87	3.91	15.50	--
1/2 Blood (60s and 62s)	40.54	43.92	54.79	29.70
3/8 Blood (56s and 58s)	45.53	44.93	20.60	28.18
1/4 Blood (50s)	2.78	6.29	7.61	38.71
Low 1/4 Blood (46s & 48s)	.28	.95	1.50	3.41
	Mean fiber diameter in microns (From cross-sections)			
	23.66	--	22.79	25.65
	Spinning count (A.S.T.M. standards for wool tops)			
	62s	--	62s	58s
	Percent of total matchings sorted			
Length (all grades)				
Staple	35.26	86.13	31.68	52.14
French and Clothing	64.74	13.87	68.32	47.86
	Average staple length in inches			
	3.61	--	3.63	4.07

Cross-section results show that yearling Targhee ewe fleeces are coarser than yearling Targhee ram fleeces although both would qualify as 62s. This is somewhat finer than the sorting results show. Average fiber diameter from cross-sections of mature Targhee ram wool was on the fine side of 3/8 Blood. Sorting classified 58% of the mature ram wool as 3/8 Blood or finer.

Sorting results of Targhee fleeces are not consistent with staple length measurements. On the basis of measurements at least half of the matchings from yearling fleeces would be expected to have been classified as staple. Likewise a greater proportion of mature ram wool would be expected to grade staple. Mature ewe wool normally has shorter staple length than yearling wool but more was classified as staple. These discrepancies may have resulted from slightly varying length standards between sorters and between groups of fleeces. This is to be expected with visual subjective observations. More information is needed on the meaning of visual appraisals of wool in terms of objective measurements.

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SUMMARY OF 1949 COLUMBIA FLEECE WEIGHTS BY GRADE

	"FS"		"1/2"		"3/8"		"1/4"		"L 1/4"		TOTAL	
Breed	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total
						Mature Ewes						
K			15	151.6	179	1975.2	202	2409.1	15	195.9	411	4731.8
K2	1	10.1	5	48.0	46	515.4	69	855.9	6	81.9	127	1511.3
K1B			1	13.1	4	39.0	2	20.7			7	72.8
K1L					5	55.2	6	65.8	1	14.1	12	135.1
LxR					2	18.8	3	32.4			5	51.2
Total	1	10.1	21	212.7	236	2603.6	282	3383.9	22	291.9	562	6502.2
Ave.		10.1		10.13		11.03		11.99		13.27		11.58
						Yearling Ewes						
K			6	43.5	109	903.1	41	366.6	4	43.9	160	1357.1
K2					8	71.1	2	15.6			10	86.7
K1B	1	10.9	17	148.5	55	502.9	5	48.8			78	711.1
Total	1	10.9	23	192.0	172	1477.1	48	431.0	4	43.9	248	2154.9
Ave.		10.9		8.35		8.59		8.98		10.96		8.69
						Mature Rams						
K					25	375.2	16	251.6			41	626.8
Ave.						15.01		15.73				15.29
						Yearling Rams						
K			13	126.8	89	982.4	13	167.4	1	14.0	116	1290.6
Ave.				9.75		11.04		12.88		14.0		11.13

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SUMMARY OF 1949 TARGHEE FLEECE WEIGHTS BY GRADE

	"FF"		"FS"		"1/2"		"3/8"		"1/4"		TOTAL	
Breed	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total
						Mature Ewes						
T	7	69.8	17	160.7	148	1553.5	133	1500.5	5	57.7	310	3342.2
Tl	3	32.2	22	226.2	190	2166.8	104	1276.9	1	7.7	320	3709.8
Total	10	102.0	39	386.9	338	3720.3	237	2777.4	6	65.4	630	7052.0
Ave.		10.20		9.92		10.01		11.72		10.90		11.19
						Yearling Ewes						
T			22	164.6	68	541.7	50	420.8	1	9.8	141	1136.9
Tl			2	18.0	20	185.6	26	258.1	2	26.5	50	488.2
Total			24	182.6	88	727.3	76	678.9	3	36.3	191	1625.1
Ave.				7.61		8.26		8.93		12.10		8.51
						Mature Rams						
T					12	155.9	13	212.0			25	367.9
Tl					6	92.7	11	192.5			17	285.2
Total					18	248.6	24	404.5			42	653.7
Ave.						13.81		16.85				15.55
						Yearling Rams						
T			14	140.8	69	731.7	8	97.6	1	13.2	92	993.3
Tl					10	125.6	4	54.0			14	179.6
Total			14	140.8	79	867.3	12	151.6	1	13.2	106	1172.9
				10.06		10.98		12.63		13.20		11.07

SCOURABLE BRANDING FLUID

In order to provide a convenient record of the scourable branding fluid investigations, in which this Station and Laboratory have cooperated with the Wool Division, Livestock Branch, Production and Marketing Administration for a number of years, we are quoting verbatim the most recent discussion of the subject as that occurs on pages 26-27 and 45 in Vol. Xi, No. 9, September, 1950, The National Wool Grower under the title, "The New Scourable Branding Fluid for Sheep", by George C. LeCompte.

"The branding of sheep has long posed a two-way problem. If the branding material were durable enough to stick to wool for long periods of time as it must, it usually would not scour easily from the fleece, thus creating a serious and costly removal problem in the wool manufacturing process. If the brand scoured easily, it conversely would not have the durability needed. Seemingly, the problem called for a branding fluid of contradictory sticking and non-sticking characteristics and it is no wonder that it has plagued wool producers and processors for many years.

Sheep give the Answer

After trying many different materials in the search for a fluid that would combine the properties of durability and scourability, the quest in Production and Marketing Administration Livestock Branch laboratories for this elusive material ultimately led back to the sheep. The grease cleaned from sheeps' wool, known as lanolin, undergoes a long period of exposure to air and sunlight and as a result has none of the drying and hardening properties of ordinary oils. Happily it can be washed from wool in the normal scouring process. Laboratory experiments indicated that lanolin was the simplest and perhaps most obvious vehicle for the scourable branding fluid.

The next step--testing this lanolin-base fluid under actual western grazing conditions--proved conclusively that the product met the first of the two necessary requirements. Branding marks made by this fluid were both intact and clearly legible after a year of exposure to the rigorous Idaho Rocky Mountain climate. This field test was made on around 3500 sheep at the Bureau of Animal Industry Sheep Experiment Station at Dubois, Idaho.

The Branding fluid also met the second requirement of being completely removable from the wool in the usual scouring process. Wool on which the brands had been painted was sorted from the remainder of the fleeces and sent on for processing into cloth at the Forstmann Woolen Company. This firm's Director of Research, Werner von Bergen, observed and described the scouring operation in detail. Included in the shipment was one sort of 835 pounds of fine and half-blood wool, and another sort of approximately 380 pounds of three-eights and quarter-blood wool. Mr. von Bergen pointed out that all of the wool from these two sorts was carded, combed and woven into cloth which was completely free of the discoloration that normally appears from branding marks.

Paint Marks are Costly

In his report, Mr. Von Bergen elaborates on some of the problems wool manufacturers face in handling paint wool. He points out that in 1949 the average sorter in his company spent one-half hour daily in clipping paint wool. The total cost of this work was figured at $4,300. Further, this company sold about 6,000 pounds of this wool containing branding paint for 17 to 18 cents a pound whereas such wool had cost from 75 cents to a dollar a pound. These two costs totaled over $10,000. and the company's troubles didn't end with this.

Mr. von Bergen points out that it is not humanly possible for wool sorters to detect all wool carrying brand marks, with the result that some carry into the manufacturing process and later show up as unsightly spots in the cloth. Removing the spots is a painstaking hand operation. Mr. von Bergen explains that in 1949 his company handled approximately 1,500,000 pounds of wool with branding marks, and despite the fact that the paint wool was clipped and sold at a great loss, 23,000 pieces of cloth made from the wool had to be subjected to this costly cleaning or "depitching" process. The total cost of this was figured at more than $38,000. Thus all the costs of handling this paint wool averaged about 3.23 cents per pound, clean basis, on the 1,500,000 pounds of wool originally marked with non-scourable branding marks.

Losses Must be Shared

While most of the paint or brand problems in paint wool center in the manufacturing process, producers also have a considerable stake in this problem. No doubt, companies other than Mr. von Bergen's have similar troubles with paint wool. Certainly a part of their cost is reflected back to the grower in lower prices for wool marked with a non-scourable branding fluid.

To help solve this difficulty and also to improve the marketability of wool, the research work was initiated early in 1942. It was soon recognized that the desired fluid had first to withstand the combined rigors of rain, snow, immersion in streams and sheep dips, sunshine, dust storms, and physically harsh treatment such as rubbing against bushes, trees and other sheep. Passing these tests, the fluid would not be practical unless it could be removed from the wool during the normal manufacturing processes. Wool is customarily given a hot, alkaline, water bath at least once during its processing. Thus the ideal material was one that would not survive such a treatment but would wear like iron in the cold, neutral, water hazards it encountered under natural conditions on a sheep's back.

Many materials such as various fats and oils, shellac, waxes, fatty acids, casein, gelatin and glue were given consideration, while mineral oils, petrolatum, paraffin, and tars were soon discarded as possible bases. The choice of pigment or coloring matter posed a much less difficult problem because many are available which will do the job.

Tests Difficult

One by one the materials that were possibilities as a vehicle for the branding fluid were discarded as various experiments showed them to be impractical. In the 1942-43 laboratory experiments, lanolin and mixtures of it with stearic acid and rosin showed the greatest promise. However, the tests proceeded rather slowly. For one thing there was no way to make quantitative comparisons between the varied formula because it was an all or none basis--either the fluid scoured or it did not. Another problem was the failure of accelerated laboratory aging processes to duplicate actual conditions. An experimental brand might remain scourable throughout all of the laboratory processes of baking, exposure to water, natural sunlight or artificial light. In the field, however, fluids which appeared successful in the laboratory were not always scourable after exposure on sheeps' backs. The reason for this was not determined but probably resulted from extraneous materials that impregnated the brands as the sheep grazed.

Correct amounts of pigment or coloring matter were found to be extremely important in actual tests. If the amount was too little, the brand was not as clear and distinguishable as it should have been. On the other hand, if the amount was too much, the scourability was impaired.

Lanolin Base Proves Out

First practical field test was begun by branding 50 sheep at the BAI sheep station at Dubois. But these tests progressed slowly because of occasional evidences of unscourability while laboratory operations indicated the fluids to be completely scourable. A large-scale field test was started in the spring of 1947, to be followed by a commercial scouring of the branded wool in 1948. This was not completed because, unfortunately, ordinary paints were applied to some of the fleeces by mistake. By the spring of 1948, when the second large-scale test described earlier was undertaken, the lanolin formula* had proved itself to be the most durable and scourable. In the summer of 1949 the fleeces were sheared and after the year's exposure, the brands showed satisfactory durability. The black scourable brand was clearly legible--the blue while still distinct, had darkened and was difficult to tell from the black--the red was satisfactory--the green was a trifle faint but a higher concentration of pigment corrected this fault. Only the yellow had blended with dust on the fleece and was indistinguishable.

Although this first lanolin base fluid was successful, one defect appeared. In cold weather, the fluid stiffened excessively. Use of rosin with the lanolin has since permitted the use of more solvent so the product is now thick enough in warm weather and does not stiffen badly in cold weather. Another development in the offing is a more fluid lanolin.

With such experiments proving good durability and excellent scourability for this branding fluid, a practical and successful product is a reality. Growers should soon have an opportunity to

* The formula: Lanolin, 100 parts by weight, Carbon tetrachloride, 25 parts by volume; and Pigment, 3 parts by weight.

remove the paint defect from their wool through the use of branding fluids manufactured on this formula. Great impetus may be given to this needed change if wool buyers and manufacturers would consider a premium in prices for wools free from non-scourable paint. This development could well be another step in the advancement of a great American industry."

GRAZING STUDIES IN COOPERATION WITH THE FOREST SERVICE

Grazing of the experimental pastures was deferred in 1949 to allow a complete inventory of the vegetation. Although analyses of the data for most of the grazing treatments have not yet been completed, the relative effects of spring and fall grazing are apparent. One 80-acre pasture was grazed only in the fall, whereas an adjacent pasture was grazed in the spring and again very lightly in the fall. After 25 years of treatment, the two pastures that were originally similar differed greatly. Heavy fall stocking had little effect on the vegetation, and the fall grazed area remaining in good condition. The area grazed in the spring, however, contained 173 percent as many shrubs (mostly undesirable sagebrush), 72 percent as much grass, and only 20 percent as many forbs as the fall-grazed pasture. The spring-grazed pasture changed from good to poor condition, and its grazing capacity was reduced to less than one-third of that of the fall-grazed pasture.

From results of this study the following conclusions were drawn with respect to sagebrush-grass range of the Upper Snake River plains:

1. Heavy fall grazing does not markedly affect grass and forb production, but it may cause a decrease in shrubs if they are heavily utilized.

2. Heavy spring grazing severely reduces grass and forb production and greatly increases the abundance of undesirable shrubs.

3. A range in poor condition improves very slowly if it is continually grazed in the spring at even a light stocking rate.

4. Grazing ranges in poor condition in the fall only, is one method of improving such range without necessitating a heavy reduction in stocking.

SHEEP AND WOOL PRODUCTION IN AUSTRALASIA

Dr. C. E. Terrill visited Australia during September and October and New Zealand during early November in the fall of 1949 to study public and private technological services to woolgrowers in Australasia and to collect wool samples. This brief summary will be followed by a more complete report to be published later.

Australia has a population of about 120 million sheep. The bulk of the sheep are kept in areas with annual rainfall of from 15 to 30 inches. Intensity of grazing varies from about one sheep per acre up to one sheep to 20 to 25 acres. About 80 percent of the sheep are Merinos and are kept primarily for wool production. Wethers are run for production of wool, and lamb production is much less important than in the United States. About 20 percent of the sheep are crossbreds, many resulting from crossing Merinos with British breeds like the Leicester. Another cross to a mutton breed such as the Dorset Horn or Southdown is usually made for fat lamb production. Fat lamb production is usually confined to the higher rainfall and good farming areas.

Sheep are run entirely in fenced pastures. Problems of management include water supply, rabbit control, drought feeding, and control of diseases, parasites and blowfly strike. Mineral deficiencies are important in some areas. Lambing generally takes place from March to June, shearing from July to October and mating from October to January. However, any of these operations may take place at any time of the year in certain areas. Lambing often takes place in the spring (September to November) as well as the fall. Labor is used as sparingly as possible.

Australian wool by American standards appears to be predominately Half-Blood although considerable amounts of Fine and 3/8 Blood wool are produced. Wool marketing is well organized and efficient. Each fleece is skirted and classed in the shearing shed before baling although small operators may send their clips to the wool store for classing and sometimes also for skirting. Small clips are often bulk classed and then interlotted or pooled so as to combine several clips. Larger lots sell to a better advantage. The whole objective of skirting and classing the wool is to put it into lots that will sell to the best advantage. The wool is practically all sold at auction through brokers. The Australian producer has a real advantage over the American producer in that Australian wool is sold under international competition.

Australian Merinos are efficient producers of wool. They excel our comparable wool breeds such as the Rambouillet, Targhee and Columbia in length of staple, density, clean-wool production and, except for the Columbia, in open face. However, they are smaller, have poorer mutton conformation and condition and more skin folds than our breeds. The greater density and longer staple of the Australian Merino usually results in less weathering at the tip than in American wools. The Australian Merino comprises a number of strains which vary from the Superfine Merino producing fine wool to the Medium-wool Merino producing fine or Half-Blood wool, and the Strong-wool Merino producing 1/2 Blood or 3/8 Blood wool. Lamb production is lower for the Australian Merino than for our breeds.

The most common breeding method used with Australian sheep is mass selection. The classing of sheep for breeding is often done by professional classers or State Extension men. The selection practiced appears to have been effective particularly because many large flocks stay in the same family for generations and selection ideals are kept fairly constant. Furthermore, selection in the Merino has been directed almost entirely toward wool production rather than wool and lamb production as in the United States. Progeny testing appears to be overemphasized but this is probably not true in actual practice. The tendency in Australia to produce stud rams under the best feed and climatic conditions appears to be unfortunate as selection for adaptation to less favorable environmental conditions is avoided.

Education for sheep and wool work is provided in Colleges and Universities. Training in Colleges is usually below University standards and is practical in nature. Wool classing is taught in most states. Students interested in more advanced work generally take Veterinary Science courses or Agricultural courses in Universities. Extension work and applied research is generally taken care of by the State Department of Agriculture. The Federal Government is responsible for most of the fundamental research. Emphasis on fundamental research appears to be greater than in the United States. With regard to sheep breeding there seems to be more interest on the part of the research agencies in learning how to produce superior sheep rather than in acually producing them.

Sheep and wool research in Australia in the past has been more active in the fields of diseases and parasites and nutrition than in sheep breeding. Sheep breeding studies now underway involve selection, progeny testing, inbreeding, and strain trials. Grazing studies on the rate of grazing and systems of grazing with sheep are conducted in several states. Wool research involves intensive studies on wool growth and the factors affecting it. Fleece surveys are being made to determine the most economical grade of wool to produce under different environments.

Animal production in New Zealand is largely concerned with the harvesting of grass by livestock. Pastures are excellent over much of the islands. Grazing intensity of 4 to 6 sheep per acre is common. About 85 percent of New Zealand's 30 million sheep are Romneys or of Romney breeding. These are used for producing replacement ewes on the higher country and after about 4 years of age they are taken to lower country to produce fat lambs from mutton sires. Wool production is less important and fat lamb production is more important than in Australia. Wool production, although of generally coarser grades than Australia, is very important in the economy of New Zealand. Wool marketing methods are similar to those in Australia.

THE EFFECT OF SUCCESSFUL EMBRYO TRANSPLANTATIONS ON THE PROGRESS EXPECTED FROM SELECTION

The current interest in embryo transplantation (the transfer of a developing embryo from the reproductive tract of one female to the reproductive tract of another female) prompted an investigation into its possible application to livestock improvement.

Due to the early stage of research on embryo transplantation it is impossible to determine how successful the technique will become or what methods will evolve as the most useful. However, by using the limited information available and a specific set of assumptions as to method and success level, it is possible to arrive at approximations of the progress expected from selection under embryo transplantation in relation to the progress expected from selection under the present breeding system.

The primary way in which embryo transplantation could increase progress from selection is by increasing the number of offspring per breeding female per year. Fewer breeding females would be needed to produce each offspring generation and therefore a smaller and genetically better segment of the female population could be selected for reproduction. Evidence from cattle, sheep and swine indicates that ten is the approximate maximum number of embryos recoverable on the average from a single sacrificed female in which superovulation has been produced. Best fertility is obtained from moderate hormone stimulation timed to produce superovulation on or near the day of normal ovulation. The assumption that a maximum of 50 percent of transplanted embryos would be viable results in an upper limit of five offspring per donor female per ovulation. Repeated recoveries of embryos from the live female appear to be necessary to materially increase the progress from selection. If it is assumed that superovulation and recovery of embryos could be performed twelve times per year in cattle and swine and eight times per year in sheep, the maximum number of offspring per donor female per year would be sixty in cattle and swine and forty in sheep. Many technical problems, as yet unsolved, place these estimates far out of reach at the present time. Whether they can ever be achieved is unknown.

In order to calculate the progress expected from selection, a table of the selection differentials (in standard deviation units) obtained when saving from .1% to 99.9% of the population was constructed. Use of this table in conjunction with a knowledge of the variation in offspring genotypes, permitted estimation of the progress expected from selection under embryo transplantation in relation to the progress expected from selection under the present breeding system. Estimates were obtained for each class of livestock for success levels of embryo transplantation ranging from 1/2 to 5 offspring per donor female per ovulation.

The maximum progress expected from the first generation within-herd selection under embryo transplantation in dairy cattle, sheep, beef cattle, and swine under the specific assumptions used would be 3.58, 2.87, 2.76 and 1.13 times the progress expected from selection under the present breeding system. These figures apply to producing individuals only. Since the donor females would probably be removed from production and gestation, improvement in the herd average would be much less and could decline for most traits. For example, in a 305 cow herd even at

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the maximum success level the average butterfat production of the herd could decrease 3.50 pounds per cow per year under embryo transplantation despite a gain of 3.58 pounds per producing cow per year (assuming a present gain of one pound per cow per year). However, the gain obtained per producing female would be reflected in an increased herd average as soon as embryo transplantation was discontinued. The figures for relative progress under embryo transplantation are based on selection of females. They are correct only under the assumption that relative progress from selection of males would be the same as that for females. However, it is likely to be much less, especially where artificial insemination is used. For this reason the figures for relative progress are probably overestimates, and it is unlikely that maximum progress in any class of livestock would exceed twice the present rate. The number of offspring produced each year would be decreased by an amount equal to the percentage of females which are donors unless embryo transplantation results in more multiple births.

The results obtained indicate that, in general, as the herd size and the number of offspring per donor female increase, the relative advantage of embryo transplantation becomes larger. At a given herd size and success level, the lower the average relationship coefficient among the offspring the greater is the relative gain from embryo transplantation. Embryo transplantation does not appear practicable in swine because of the small maximum gain, the reduction in number of offspring and the increase in expense.

Embryo transplantation will probably not be feasible or popular where artificial insemination is not. Also, improvement of livestock by selection could be accelerated more cheaply, and nearly as effectively, by the use of artificial insemination as by the use of embryo transplantation even if maximum success can be achieved. Despite some increases in the progress expected from selection through its use, embryo transplantation does not appear to be sufficiently helpful or economically feasible for general use by livestock breeders. When perfected, embryo transplantation may be of some value to dairy cattle breeders although at the present time the outlook for its widespread application to dairy cattle is poor.

Results indicate that embryo transplantation may be of value to research organizations engaged in livestock improvement. Its use would provide valuable information on the physiology of reproduction as well as information on certain environmental factors which cannot be evaluated under the present breeding system. Embryo transplantation could aid breeding programs by providing fairly large families of contemporary full sibs. It would permit more rapid formation of larger inbred lines of cattle and sheep. By means of the full sib matings made possible by embryo transplantation, the present rate of inbreeding could be increased.

It is concluded that successful embryo transplantation may become a valuable tool for research organizations engaged in livestock improvement and warrants further study by research workers.